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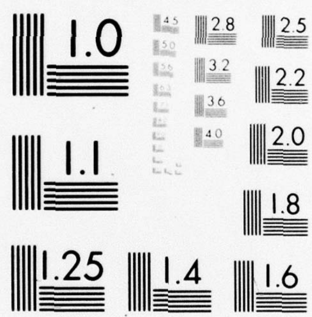

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ENGINEERING AND SCIENTIFIC RESEARCH AT WES

Miscellaneous Paper 0-73-10 September 1973

EXPANDED SERVICE TEST FOR HEAVY-DUTY LANDING MAT, *by H. L. Green, Soils and Pavements Laboratory*

Engineering traffic tests conducted at the Waterways Experiment Station (WES) (fig. 1) resulted in the scheduling by the U. S. Army Test and Evaluation Command (TECOM), Aberdeen Proving Ground, Maryland, of an expanded service test (EXST) on the first landing mat found to be capable of supporting heavy-duty aircraft. The EXST is currently being conducted under actual operating conditions at Dyess AFB, Texas, and involves actual landings of C-130 cargo aircraft and F-4C fighter aircraft (fig. 2).

A contract was awarded to the Dow Chemical Company, Midland, Michigan, for the extrusion, fabrication, and delivery of 110,160 sq ft of heavy-duty truss-web landing mat to be used in the EXST. The truss-web mat is an extruded design utilizing aluminum alloy, with individual panels weighing approximately 113 lb or 6.3 lb per square foot of placing area. Each panel is 1-1/2 in. thick, 2 ft wide, and 9 ft long. The panels are extruded at Dow's Russellville, Arkansas, plant on an 8000-ton press at a rate of 800 panels per day.

Landing mats are expedient surfacing materials designed for use as military airfields at remote locations in combat areas. The WES works with private industry in development programs of materials to meet specific military requirements.

The truss-web mat is designed to support operations of the F-111B fighter-bomber or comparable heavy-duty aircraft, which have an equivalent single-wheel load of 50,000 lb and tire inflation pressure of 250 psi. A mat to support landings and takeoffs of heavy aircraft must be superstrong. An airfield surfaced with the new Dow truss-web mat would be comparable to one constructed of 13-in.-thick portland cement concrete. A truss-web landing mat runway 100 ft wide and 6000 ft long can be built and placed in operation in less than one week as compared with a six-month construction period for conventional pavement.

Prior to the procurement of the mat for the service tests, the WES conducted engineering traffic tests on an experimental quantity of the mat, using a load cart (fig. 1)

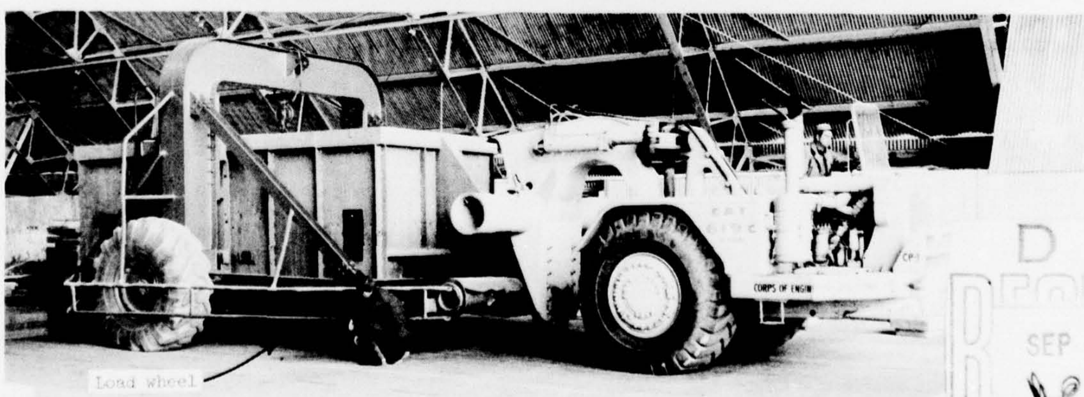

Fig. 1. WES heavy-duty load cart with 50,000-lb single-wheel load and 250-psi tire inflation pressure on extruded truss-web landing mat

Fig. 2. F-4C fighter aircraft taxiing on mat-surfaced runway at Dyess AFB

simulating one wheel of the F-111B aircraft. Service life of the mat exceeded the required number of coverages before failure. Using a jet engine mounted on a stand, the mat was subjected to a jet blast and the resulting high temperatures that are experienced during takeoff. Landings on carriers and runway overruns were simulated with arresting-hook impact tests and cable roll-over tests, respectively. The truss-web mat successfully met all of the requirements for heavy-duty mat.

In the Dyess tests, military troops placed the mat under WES supervision, and military aircraft are being used in taxiing, takeoff, and landing operations. As the developing agency, the WES is providing technical guidance during the field testing.

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SLIPFORMING FOR MASS CONCRETE,

by K. L. Saucier, Concrete Laboratory

A laboratory program was initiated to investigate the feasibility of using slipform construction for mass concrete structures. The objectives include: (a) determination to see if slipformed concrete can be utilized for mass concrete; (b) determination of basic quantitative measurements for representative concrete mixtures; (c) development of method for determining when lifting can proceed; and (d) documentation of appropriate information for preparation of a technical manual on slipform construction.

Replacing the conventional methods of cantilever forms with a slipform technique of continuous placement would be attractive economically. Problem areas using this technique in mass concrete construction include bulging of the freshly slipped concrete, large lift pressures, coordination of mix plant operation and placement rate, and the economics of large slipforms.

Four slipformed blocks 6 by 3 by 10 ft in size were cast as follows:

Block	Section	Mixture	Material Tempera-ture, °F	Slipform Rate	Slipform Material
1	Bottom	3-in. crushed limestone	73	3 in./hr (first day)	T&G lumber
	Top	6-in. crushed limestone	73	6 in./hr (second day)	T&G lumber
2	Bottom	6-in. Trumbull aggregate	40	6 in./hr	T&G lumber
	Top	6-in. Trumbull aggregate	40	12 in./hr	T&G lumber
3	Bottom	6-in. crushed limestone	40	18 in./hr	Finnform or steel
	Top	6-in. crushed limestone	40	12 in./hr	Finnform or steel
4	Bottom	6-in. crushed limestone	40	12 in./hr	Finnform or steel
	Top	6-in. crushed limestone	40	12 in./hr	Finnform or steel

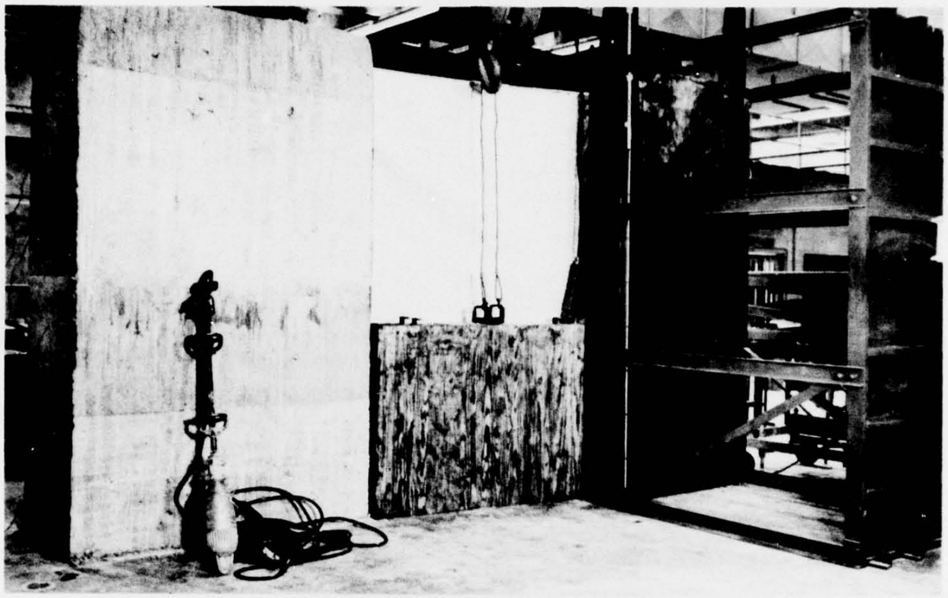

Fig. 1. Block 1 after slipping, showing vibrator, slipforms, and bulkhead form

Blocks 2, 3, and 4 were cast in 1 day's continuous operation.

Two opposite sides of each block were slipformed. For the blocks with 6-, 12-, and 18-in. slipping per hour, the slipping rate was 2 in. every 20, 10, or 6-2/3 minutes, respectively. All of the concrete in the blocks contained 35 percent fly ash by volume of cement. Block 1 after slipping, the vibrator, the slipforms, and the bulkhead form are shown in fig. 1. Variables for the test blocks included slipform rate, temperature, type of aggregate, and type of slipform.

Associated tests, i.e., slump, air content, rod penetration, time of set, etc., as required were made on the concrete. A pump aid was also used in block 3. Other information was obtained, e.g., varying types of form anchors were used and tested at early ages in some of the blocks to determine strength. The setting time of mass concrete has to be known to ensure avoidance of cold joints and proper slipform operation. The time-of-setting tests are invaluable in planning concrete operations for slipform work.

Vertical slipforming appears feasible for mass concrete if slipping is maintained between 9 and 18 in./hr at 60 F. Aggregate type is apparently not critical. However, tongue and groove lumber and impregnated plywood were easily damaged by the large aggregate (see fig. 2). Metal or

Fig. 2. Block 1, detail of side A showing abrasive action on wood

metal-lined slipforms are more durable. To minimize sloughing from the formed section, the form should be kept as nearly full as possible. Relatively high form pressures, i.e., 200 lb/lin ft (approximately twice those of structural slipforming), are likely to result. Tests conducted to determine strengths of a typical form anchor at various temperatures indicated that loads of approximately 15,000 lb per anchor would be sustained at temperatures of 40 to 50 F and that loads approaching 30,000 lb per anchor would be sustained at temperatures of 80 to 90 F. The pump aid added appeared to decrease the drag pressures approximately 150 psi.

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REPORTS RECENTLY PUBLISHED BY WES

Concrete Laboratory:

Computer Study of Steel Tunnel Supports, by G. S. Orenstein, Technical Report C-73-2, Aug 1973.

Hydraulics Laboratory:

Port Construction in the Theater of Operations, by A. A. Clark, R. J. Lacavich, et al., Technical Report H-73-9, Jun 1973.

Cellular-Block-Lined Grade Control Structure; Hydraulic Model Investigation, by B. P. Fletcher and J. L. Grace, Miscellaneous Paper H-73-7, Jul 1973.

Reflection Characteristics of Screen Wave Absorbers; Hydraulic Model Investigation, by G. H. Keulegan, Research Report H-73-3, May 1973.

Mobility and Environmental Systems Laboratory:

A Mathematical Model for Predicting Microseismic Signals in Terrain Materials, by J. R. Lundien and H. Nikodem, Technical Report M-73-4, Jun 1973.

The Use of Remote Sensing Techniques for Detection and Identification of Pollutant Discharges, by L. E. Link, Jr., Miscellaneous Paper M-73-11, Aug 1973.

Soils and Pavements Laboratory:

Effect of Constitutive Properties of Earth Media on Outrunning Ground Shock from Large Explosions, by P. F. Hadala, Technical Report S-73-6, Aug 1973.

Influence of Suction on Heave of Expansive Soils, by L. D. Johnson, Miscellaneous Paper S-73-17, Apr 1973.

Weapons Effects Laboratory:

Behavior of Lined Openings in Jointed and Unjointed Model Rock Masses, by J. G. Wallace, Technical Report N-73-6, Sep 1973.

Explosive Excavation Research Laboratory:

Analysis of Ground Motions and Peak Particle Velocities from Cratering Experiments at Trinidad, Colorado, by T. M. Tami, Miscellaneous Paper E-73-3, Jun 1973.

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